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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/530,778

Applicant(s)

KARICHEV ET AL.

Examiner

Maria J. Laios

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The listing of references in the Search Report is not considered to be an information disclosure statement (IDS) complying with 37 CFR 1.98. 37 CFR 1.98(a)(2) requires a legible copy of: (1) each foreign patent; (2) each publication or that portion which caused it to be listed; (3) for each cited pending U.S. application, the application specification including claims, and any drawing of the application, or that portion of the application which caused it to be listed including any claims directed to that portion, unless the cited pending U.S. application is stored in the Image File Wrapper (IFW) system; and (4) all other information, or that portion which caused it to be listed. In addition, each IDS must include a list of all patents, publications, applications, or other information submitted for consideration by the Office (see 37 CFR 1.98(a)(1) and (b)), and MPEP § 609.04(a), subsection I. states, "the list ... must be submitted on a separate paper." Therefore, the references cited in the Search Report have not been considered. Applicant is advised that the date of submission of any item of information or any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the IDS, including all "statement" requirements of 37 CFR 1.97(e). See MPEP § 609.05(a).

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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3. With regard to claims 1-26, the applicant states "a liquid catalytically active anode" it is the examiner's understanding that the anode consists of electrode material and the electrolytic membrane adhered to it facing the liquid electrolyte so it is unclear what is meant by "a liquid catalytically active anode."

4. In claims 8 and 9, it is unclear what is meant by "a membrane on the base of polybenzimidazole."

5. With regard to claims 13 and 20-25, it is unclear whether the system is an alloy or individual elements added into the anode.

6. Claims depending from rejected under 35 U.S.C. 112 second paragraph are also rejected for the same.

Claim Interpretation

7. With regard to claim 8, "the membrane on the base of the Polybenzimidazole" is interpreted as the electrolytic membrane.

8. With regard to claim 17, N₄ is interpreted as cobalt tetramethoxyphenyl porphyrin.

9. With regard to claim 13 and 20-25, the ruthenium nickel system is interpreted as individual elements added to the anode as catalysts and not an alloy.

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Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1, 4 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US7,056,610 relied upon for translation).

With regards to claims 1 and 4, Tetzlaff et al discloses an anode chamber (6) and air chamber (7) with a catalytically active gas diffusion cathode (col.2 lines 7-8, silver), an electrolytic chamber (5) with a liquid electrolyte (col.1 line 15) and an anion electrolytic membrane (4, col. 1 46-47, polyetheretherketone, PEEK) which is positioned between the cathode (2) and anode (3) characterized in that an aqueous alkaline solution is used as the liquid electrolyte (col. 1 lines 50-51) but fail to disclose that the fuel for the anode is a liquid alcohol. Divisek discloses an alkaline direct methanol fuel cell and teaches that the fuel can either be gaseous (as stated in Tetzlaff) hydrogen or a liquid alcohol (methanol, alcohol, col. 1 line 52-54) feed and the direct liquid feed simplifies the system (col. 1 lines 62-63)

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a direct methanol fuel of Divisek instead of the gaseous input of Tetzlaff in order to simplify the system by not including a reformer to make the hydrogen gas.

12. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 above, and further in view of Zaromb (US 4,554,222). With regard to claims 2 and 3, Tetzlaff as modified by Divisek teaches the alcohol –air fuel cell as discussed above and incorporated herein but fails to disclose electrolyte membrane as a porous matrix, an asbestos matrix, impregnated with an alkaline solution. Zaromb discloses that a separator can be an ion exchange membrane or asbestos (col. 2 lines 35-37). The liquid electrolyte of the electrolytic chamber would then impregnate the asbestos to form the electrolytic membrane.

It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the ion exchange membrane of Tetzlaff as modified by Divisek with the asbestos matrix of Zaromb because the two kinds of separators are art recognized equivalents. See MPEP 2144.06.

13. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 4 above, and further in view of Kerres et al. (US 2002/0094466 A1).

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With regard to claim 5, Tetzlaff modified by Diveisek discloses the membrane as an anion exchange membrane of PEEK, polyetheretherketone, as discussed above and incorporated herein but fails to disclose polybenzimidazole (PBI). Kerres et al. teaches the use of PBI as an equivalent of PEEK (Paragraph 37).

It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the PEEK of modified Tetzlaff with the PBI of Kerres because PBI is an art recognized equivalent. See MPEP 2144.06.

14. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 and further in view of Tosco et al (US 2001/0036570 A1).

With respect to claim 6, Tetzlaff modified by Divisek teaches the structure of the fuel cell as discussed above and incorporated herein but fail to disclose a two layer gas diffusion layer with a hydrophobic layer (hydrophilic barrier) next to the electrolyte chamber and the active material facing the air chamber. Tosco et al discloses a gas diffusion electrode for use in a fuel cell and teaches a blocking layer and an active layer and the blocking layer is used to prevent the aqueous electrolyte from escaping through the electrode (Paragraph 22).

It would have been obvious to one of ordinary skill in the art at the time of the invention to place the blocking layer of Tosco into the electrode of modified Tetzlaff in order to prevent the aqueous electrolyte from escaping through the electrode

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15. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 and further in view of Yeager et al (US 4,975,172)

With regard to claim 7, Tetzlaff modified by Divisek teaches the structure of the cell as discussed above and incorporated here in but fails to disclose the hydrophobic layer (hydrophilic barrier) next to the air chamber. Yeager et al discloses a fuel cell in which the hydrophobic layer (40) is next to the air chamber (15) in order to prevent the liquid electrolyte from entering the gas side of the cell (leakage) (col. 6 lines 29-34).

It would have been obvious to one of ordinary skill to place the hydrophobic layer of Yeager next to the air chamber of Tetzlaff modified by Divisek in order to prevent the leakage of the electrolyte into the air chamber.

16. Claims 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 and further in view of Kerres et al. (US 2002/0094466 A1) and Ovshinsky et al. (US 2002/0064709 A1).

With regard to claim 8, Tetzlaff modified by Divisek discloses the structure of the fuel cell as stated above and incorporated herein but fails to disclose the anode having a 3-7 percent fluoroplastic (binder) and the electrolytic membrane made with PBI. Kerres discloses that PEEK and PBI are functional equivalent of each other (paragraph 37) but fails to disclose the amount of binder included in the anode. Ovshinsky discloses the use of PTFE as the binder for an anode

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with the weight percent in the range of 2 – 30 in order to prevent the leakage of the electrolyte into the anode chamber (Paragraph 56).

It would have been obvious to one of ordinary skill at the time of the invention to include the PBI of Kerres into the fuel cell structure of Tetzlaff as modified by Divisek as it is a functional equivalent of PEEK for a membrane component and to include a binder in the anode with the weight percent of 2-30 in order to prevent the leakage of the electrolyte into the anode chamber.

With regard to claim 10, Tetzlaff modified by Divisek discloses the diffusion layer is intimately joined by with the electrolyte (col. 2 line 66) but fails to disclose a diffusion layer/porous nickel band filled with polybenzimidazole (PBI) and 3-7 weight percent of fluoroelastic in the active material. Kerres et al. discloses that polybenzimidazole (PBI) and PEEK are functional equivalents of each other (Paragraph 37) as discussed above and incorporated herein. Ovshinsky discloses a foamed nickel substrate, (Paragraph 46) and the use of 2 -30 weight percent of the binder (polytetrafluoroethylene, PTFE) for the anode in order to prevent the electrolyte from entering the anode chamber (Paragraph 56).

It would have been obvious to one of ordinary skill at the time of the invention to have the to have the fuel cell of Tetzlaff modified by Divisek with the PBI of Kerres with the foamed nickel substrate of Ovshinsky filled with the PBI in order to prevent leakage of the electrolyte into the anode chamber and the porous nickel support would give a high surface area for catalytic reactions to occurs.

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17. Claim 9 rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 and further in view of Koschany et al. (US 6,183,898 B1).

With regard to claim 9, Tetzlaff modified by Divisek teaches the structure of the fuel cell as stated above and incorporated herein but fails to disclose the anode having a 2-7 percent PBI and the electrolytic membrane made with PBI. Koschany discloses that PEEK- a polyether ketone) and PBI are functional equivalent of each other (col. 3 lines 19-21) and discloses the amount of binder from 2 to 50% mass (col. 3 line 34). The binder material is the same material as the membrane material and this will increase the ionic conduction through the membrane.

It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the electrolytic membrane of modified Tetzlaff with a PBI membrane of Koschany as it is a functional equivalent of PEEK for a membrane because PBI and PEEK are an art recognized equivalent. See MPEP 2144.06.

18. Claim 11 rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 and further in view of Ovshinsky et al. (US 2002/0064709 A1) and Koschany (US 6,183,898 B1).

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With regard to claim 11, Tetzlaff modified by Divisek teaches the diffusion layer is intimately joined by with the electrolyte (col. 2 line 66) but fails to disclose a diffusion layer/porous nickel band filled with polybenzimidazole (PBI) and 2-7 weight percent of PBI in the active material. Ovshinsky discloses a foamed nickel substrate, (Paragraph 46) and the use of 2 -30 weight percent of the binder (polytetrafluoroethylene, PTFE) for the anode in order to prevent the electrolyte from entering the anode chamber (Paragraph 56). Koschany discloses that PTFE and PBI are binder material and have an equivalent function (col. 3 lines 19-21).

It would have been obvious to one of ordinary skill at the time of the invention to have the to have the fuel cell of Tetzlaff modified by Divisek with the PBI of Koschany with the foamed nickel substrate of Ovshinsky filled with the PBI in order to prevent leakage of the electrolyte into the anode chamber and the porous nickel support would give a high surface area for catalytic reactions to occurs

19. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 above and further in view of Zaromb (US 4,554,222) and Koschany (US 6,183,898 B1).

With regard to claim 12, Tetzlaff as modified by Divisek discloses the alcohol –air fuel cell as discussed above and incorporated herein and teaches the membrane/electrolyte can be diffused into the electrode but fails to disclose electrolyte membrane as a porous matrix, an asbestos matrix, impregnated with an PBI solution and a binder of floroplastic and PBI. Zaromb discloses

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that a separator can be an ion exchange membrane or asbestos (col. 2 lines 35-37). One of ordinary skill would know to impregnate the asbestos material with an electrolyte such as PBI, which is a functional equivalent of PEEK, disclosed by Divisek, in order to promote the reaction of the cell. Koschany discloses that Poly ether ketones and PBI are binder materials and have an equivalent function (col. 3 lines 19-21) and can have a mass ratio of 1:100-100:1 in the electrode (col. 33-35).

It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the ion exchange membrane of Tetzlaff as modified by Divisek with the asbestos matrix of Zaromb because asbestos and the ion exchange membrane are art recognized equivalents. See MPEP 2144.06.

20. Claims 13 and 20-25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 above and further in view of Biberbach (6,814,777) and Richter (US 3,673,116)

With regard to claims 13, and 20-25 Tetzlaff as modified by Divisek teaches the fuel cell as discussed above and incorporated herein but fails to disclose a catalyst for the anode as a nickel ruthenium system. Biberbach discloses the a Pt-Ru alloy that is an effective catalyst in a fuel cell system with the size of a Pt:Ru as 5.2 nm and a BET surface area of greater than 40 m²/g (col.2 line 43, col. 7 line 8, in the table) and exhibits long term stability in DMFC (col. 7 line 3)

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Richter discloses an effective catalyst for a fuel cell as Raney nickel aluminum molybdenum (col. 1 lines 42), which is more effective than Raney nickel alone (col. 1 line 45).

It would have been obvious to one of ordinary skill in the art to combine the Pt:Ru and the Raney Ni-Al-Mo with the appropriate compositions in order to make an effective and optimal catalyst for a fuel cell. It is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose *In re Kerkhoven* 205 USPQ 1069, 1072. It has been held in the courts that when the general conditions of a claim are similarly disclosed in the prior art, it is not inventive to optimize general conditions as concentration. *In re Aller, Lacey and Hall*, 105 USPQ 233,235.

21. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation), Biberbach (6,814,777) and Richter (US 3,673,116) as applied to claim 13 above, and further in view of Kerres (US 2002/0094466 A1).

The disclosures of Tetzlaff, Divisek, Biberbach and Richter as discussed above and incorporated herein.

With regard to claim 26, Tetzlaff discloses an porous anode (3) with an electrolyte layer/the layer facing the electrolyte (4) and discloses the catalyst may be embedded in the ion exchanger in part (col. 1 lines 66-67) this would then make a layer of the catalyst and the ion exchange member in addition to the other two. Tetzlaff fails to disclose the electrolytic membrane as PBI but instead

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discloses it as polyetheretherketone (PEEK). Kerres teaches that PEEK is a functionally equivalent to PBI (Paragraph 37).

It would have been obvious to one of ordinary skill in the art to replace the PEEK with the PBI since both are art-recognized equivalents. See MPEP 2144.06.

22. Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 and further in view of Biberbach (6,814,777) and Ozin et al. (4,569,924).

With regard to claims 14-16 Tetlaff discloses Tetzlaff as modified by Divisek discloses the fuel cell as discussed above and incorporated herein wherein the catalyst is silver but fails to disclose the silver is 7-18 weight percent on the carbon carrier and the surface area is 60-80 m²/g. Ozin et al. discloses a silver-carbon catalyst with a 0.1-15 weight percent (col. 6 lines 26-30) for use in a fuel cell as teaches that the size will determine the efficiency of the fuel cell (col. 7, lines 18-29) that shows by making the size/surface a result effect variable. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the silver –carbon catalyst of Ozin in the fuel cell of in place of silver in modified Tetzlaff in order to increase the overall surface area of the silver in the electrode.

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23. Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tetzlaff et al. (US 5,656,389) in view of Divisek (WO01/61776 – US equivalent document US 7,056,610 relied upon for translation) as applied to claim 1 above and further in view of Solomon et al. (US 4,615,954).

With regard to claims 17 –19, Tetzlaff as modified by Divisek teach the fuel cell with a silver cathode catalyst as discussed above and incorporated herein but fails to disclose a pyropolymer on a carbon carrier with a 10-20 weight percent and a surface area of 60-80 m²/g. Solomon et al. discloses catalyst used for a gas diffusion electrode in which the catalyst is cobalt tetramethoxyphenyl porphyrin on carbon with a 5-25 percent of the catalyst and is an art equivalent catalyst of silver (col. 3 lines 30-40).

It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the silver catalyst of Tetzlaff modified by Divisek with a cobalt tetramethoxyphenyl porphyrin – carbon catalyst because cobalt tetramethoxyphenyl porphyrin – carbon catalyst is an art recognized equivalent of silver as a fuel cell catalyst. See MPEP 2144.06.

It would have been obvious to one of ordinary skill to change the size of the carbon to have a surface area of 60-80 m²/g instead of 1000 m²/g as in order to increase the overall surface area of the catalyst in the electrode.

Conclusion

24. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria J. Laios whose telephone number is 571-272-9808. The examiner can normally be reached on Monday - Thursday 9:30 - 6:30.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MJL


PATRICK JOSEPH RYAN
SUPERVISORY PATENT EXAMINER